GROUNDWATER RECHARGE

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GROUNDWATER RECHARGE WHY AND HOW AND WHY NOT DO MORE

A GENERAL DISCUSSION OF GROUNDWATER RECHARGE IN NORTH SANTA CLARA COUNTY

by

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Description of the Area of Discussion:

The area covered in this discussion is the North Santa Clara Valley Groundwater Basin. The basin is mainly composed of alluvial fill and has a length of 20 miles and a width of up to 14 miles. The lower portion of the North Santa Clara Valley Groundwater Basin is a narrow valley (Coyote Valley) which is approximately 8 miles in length and 4 miles in width. The basin was formed when a large block of the Earth's crust, essentially bounded on the east by the Hayward and Calaveras Faults and on the west by the San Andreas Fault was down dropped to form a depression. Both surface and subsurface drainage for the groundwater basin is northward into San Francisco Bay. The geology of this area is extremely complex. Essentially non-water bearing reaches occur in the upland area adjacent to the groundwater basin and underlies the water-bearing alluvial deposits at depth beneath the valley floor. The underlying bedrock units consist predominately of consolidated sedimentary rock units with subordinate metamorphic and igeneous rocks. Overlying the bedrock

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units are the water-bearing Plio-Pleistocene Santa Clara Formation and the recent alluvium. The Santa Clara Formation consists of semi=consolidated sand and gravel deposits mixed with beds of silt and clay.

Unconsolidated alluvium and bay mud deposits overlie the Santa Clara Formation and form the valley floor. The Recent alluvium is the principal water-bearing formation.

The Growth of Water Demands:

Early water users in the valley recognized the groundwater supply but made few demands upon the total supply. The earliest users were the Spanish who grazed cattle over much of the area during the late 1700's and early 1800's. Grain was then raised in much of the valley from the mid-1800's to early 1900's. Much of the grain was raised in the bayland portion of the valley and was irrigated by artesian wells. Prune orchards and vineyards began to take a strong hold followed closely by the apricots about the turn of the century.

The availability of electrical power and the development of the deep well turbine pump gave the farmer a method of controlling his own water destiny. In 1910, approximately 30 percent of the farms in the County were irrigated. By 1920, 67 percent of the growing number of farms were under irrigation.

Great demands were placed on the groundwater supply during the period of 1920 to 1936 due to abnormally low rainfall and increasing irrigation and domestic use. The average depth to water in the valley dropped from 55 feet to 138 feet. Agriculturalists began to express concern early in this period and as a result of this concern the Water Conservation District was formed in 1929. The purpose of the District was to capture winter runoff by constructing dams and releasing water gradually during dry periods to recharge the underground basin.

During the next six years, (1936-1942) due to the construction of six of the District's reservoirs and above average rainfall, the average depth to water rose from an average depth of 138 feet to 61 feet. Then again, during the period 1942 through 1950, below normal rainfall combined with increasing municipal and industrial demands saw the water table fall to a historic low of 158 feet.

Since 1950, the longest period of time that we experienced below normal rainfall was the four-year period of 1959 through 1962. All the while the population continued to grow rapidly; in 1940 - 180,000; 1950 - 280,000; 1960 - 680,000; 1970 - well over a million. This rapid growth placed increasing demands on our groundwater supply until 1967 when the Rinconada Water Treatment Plant was put into operation. Since that time, groundwater demands have eased somewhat.

How the Groundwater Basin is Recharged:

Agriculturalists were aware that the water levels in their wells were a reflection of the winter rains. The extremely low rainfall that occurred in the 1920's brought about demands to conserve the limited runoff. In order to do this, farmers joined together to form the Santa Clara Valley Water Conservation Association. The early efforts of this group consisted of building low dams in streams to spread water in stream channels and in some cases adjacent fields. This concept is basically the same today as it was in 1926.

At this time the District maintains and operates 500 acres of offstream recharge facilities and, in addition to this, water is released at controlled rates in every major stream channel in North Santa Clara County.

The alluvial valley is made up of gravel, sand, silt and clay layers. Some hydraulic interconnection usually occurs between the permeable layers of sand and gravel. Most of the more permeable layers are sealed from the surface to some extent by impervious layers of clay. In some areas, however, the gravel layers reach the surface or occur as near surface deposits. It is at these areas that artificial recharge facilities can be developed. Generally, the best areas for recharge are located closest to the foothills where the major streams enter into the valley floor. Infiltration rates are generally less in recharge ponds located near the bay. During peak periods of recharge an excess of 600 acre-feet of water per day is infiltrated by way of the natural channels and offstream recharge ponds of the South Bay Aqueduct System. Some of the District's individual ponds have recharge rates as high as 6 acre-feet per acre per day (6 feet per day) while others have rates as low as 1/2 of one acre-foot per day.

The general procedure that we follow to determine flow releases for recharge is established each spring at the end of the rainy season. At that time an evaluation is made of available local and imported water and release schedules are developed. Some of the priorities that influence release schedules are: maintenance and construction needs, recreational needs, irrigation needs and allocation of water to areas most in need of recharge.

In years of high reservoir storage an effort is made to maximize recharge in the stream channels. To do this, the District may install as many as 50 temporary gravel and board dams across various streams. Also, bottoms of many stream channels are ripped, leveled, and in some cases, small mounds built across the channel to spread water. During years when less water is available, the District efforts are scaled down proportionately. In any case our first priority for releases is the natural channel, and next the offstream recharge facility.

It must be kept in mind that not all recharge facilities can be operated at maximum efficiency at all times. We must provide time for maintenance and construction in natural channels and offstream ponds must be shutdown from time to time for cleaning. In addition to this, the District has no storage facility to handle imported water. This means that some of the recharge capacilities must be allocated to treatment plant fluctuations. Weather conditions from November through April dictate operational patterns. Greater priority is placed on using offstream facilities for recharge of imported water. Natural runoff supplemented by imported releases and some reservoir storage releases provide flows for the natural channels during the winter months.

Why Do We Recharge the Underground Basin:

Over the period of the last 70 years, groundwater has been developed as a principal source of water supply for the people of Santa Clara County. About 45 years ago, however, banks sometimes refused to loan money on agricultural property because it was felt that there was not enough water available for further agricultural development. The desire to continue the growth in both agriculture and commerce in Santa Clara County led to the formation of the Valley Water Conservation District and the inception of the groundwater recharge program.

At about the same time the first six dams were on the drawing boards (1932), the U. S. Coast and Geodetic Survey brought to public attention a major effect of the continued overdraft of the groundwater basin. Releveling of a 1912 first order level line indicated that there had been a settlement of several feet at San Jose. Gradually, the effects of subsidence became apparent. The change in grade of drainage structures greatly limited their capabilities. Natural stream channel grades were changed so that the upper portions were steeper causing erosion problems and in the lower portions of the channel grades were flattened causing a limiting of capacity plus greater deposition of material. All of which contributed to flooding and property loss during the winter months.

Subsidence had serious effects on wells also. As subsidence occurs, the friction between the consolidating materials and the casing of the well causes the casing to collapse. It is estimated that 80 percent of the wells in the subsidence area have suffered this kind of damage. If you were to put a dollar value on this, a rough estimate of the cost of repair to wells due to subsidence damage is in excess of 4 million dollars.

I believe that you can see that subsidence caused by groundwater depletion is a serious and expensive problem so this is part of the answer to the question, "Why do we recharge water?"

For the rest of the answer we must look at the groundwater basin as we would any major treatment distribution and storage facility. During the last six years, this plant has produced an average of 160,000 acre-feet of water each year, while at the same time, adding to its storage. To put this in perspective, last year (1971) the Rinconada Treatment Plant produced approximately 45,000 acre-feet. One of the advantages of the groundwater plant is its treated water storage capabilities. During the period of low demand, the facility continues to function as long as the water supply is maintained.

There is little doubt that the use of the groundwater basin will continue to be an important part of our future water supply system. We can provide a major portion of the valley's water needs through this facility if we manage it properly. We must be aware, however, that this basin has limitations. It can treat and deliver water on an annual basis and provide an additional emergency standby supply of water, but we must recognize the danger of abusing it and move to eliminate these abuses. We must find ways of eliminating over-pumping in areas that cannot be adequately recharged. We must protect the quality of raw water that we introduce into the underground the same way that we would the inflow to a surface-treated facility. We must also protect against any reduction of the facilities that transport water to our groundwater basin. If someone started replacing portions of our Rinconada Force Main with smaller pipe, I don't think we would stand still for it. We must accept the fact that as the valley continues to develop, less and less land is exposed to the natural recharge processes. It, therefore, makes it all the more important that we protect existing onstream recharge facilities and continue to develop additional offstream facilities.

Why Not Do More?

There are, no doubt, many ways in which we can better manage our groundwater storage and distribution system. One possibility would require forming an alliance with our old enemy, the well. Right now, *we* put it in and *they* take it out and it's an uphill fight all the way. Let me give you one or two examples.

1. Why couldn't this District develop a groundwater pumping plant in the Laguna Seca region of Coyote Valley. This system could produce 20,000 acre-feet a year and have an overall beneficial effect on that area by relieving the high groundwater conditions. This area can be easily recharged by releases from Anderson Reservoir and someday from the San Felipe Project. This same concept may be applicable to other areas of the valley as well.

2. You know that I said earlier in this talk that our best recharge rates are near the foothills and that as you move toward the bay recharge rates diminish.

The question is how can ~~b~~we effectively recharge water in these areas? One possible solution is the use of recharge wells, but before we pursue this let's look at the treated water distribution system. As it stands now, this system must be designed to handle peak flows of the users. It must have reserve storage capacity and it should have an emergency standby water supply. Keeping this in mind, is it possible that we could blend these two problems together for a common solution? If major well fields were located properly mid-way through a treated water distribution system, then it might be possible to design a pipeline for an average demand rather than a peak. At times when water demands were low a portion of the well field would be dedicated to groundwater recharge. When the demand increased, other wells would pick up the demand. The effect is that the treatment plant would operate at a constant rate and water of good quality would be stored against future emergencies directly in the use area and it would be readily available.

None of these are really new ideas. It is just a matter of looking at our water supply questions from a slightly different angle and asking the question, "How can we make the best use of our groundwater supply?"

Back in 1929, the old Valley Conservation District and now this District has been given the mission of providing water for Santa Clara Valley. The groundwater basin has the capability of providing, if properly managed, a major portion of our water needs. We must accept the fact that this District has the responsibility to manage and to protect and to use the groundwater basin, so that this mission can be most economically and practically achieved.